

Conference Abstract

Critical Analysis of Environmental Characterization Practices Through Integrated Analysis of Biodiversity Data Published in an Open-Access Database

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Abstract

To conserve and restore marine biodiversity, it is essential to critically assess the data generated so far. Recent findings showing healthy phytoplankton cells in deeper, aphotic layers challenge the traditional view that they occur only within the photic zone. This highlights the need to rethink outdated concepts and reassess current sampling strategies. Open, standardized databases offer a valuable opportunity to identify knowledge gaps and inconsistencies, enabling a paradigm shift in our understanding of marine ecosystem functioning.

In this study, we used the data from the Environmental Characterization Database ([ECD](#)) (Castellões et al. 2021) which compiles results from Environmental Baseline Studies (EBS) conducted within the scope of oil and gas (O&G) Brazilian licensing processes, to analyze the microphytoplankton biodiversity in the water column, both within and below

the photic layer. The ECD is a platform for storing marine environmental data generated by projects addressing water and sediment quality, as well as aquatic biota.

Among the 17 EBS currently available in the ECD, only four included phytoplankton sampled throughout the entire water column. Although the implementation of EBS is defined by specific guidelines issued by the Brazilian environmental agency (IBAMA/MMA 2019), phytoplankton sampling strategies are not standardized. These studies, carried out in the Southwest Atlantic, reveal the presence of healthy microphytoplankton cells from 200 m to nearly 3,000 m depth. Although cell density decreases with depth, taxonomic richness remained remarkable, evidencing unexpected biodiversity in the aphotic zone. Diatoms, dinoflagellates, and cyanobacteria are the most representative groups in the deep ocean, considering both taxonomic richness and density (cells L⁻¹). Among diatoms *Chaetoceros* spp., *Cylindrotheca closterium*, *Pseudo-nitzschia* cf. *delicatissima*, and *Thalassionema nitzschioides* are the most frequent taxa in the aphotic layer. Dinoflagellates are dominated by *Heterocapsa* spp., *Oxytoxum gladiolus*, *Prorocentrum* spp. and the order Gymnodiniales, while cyanobacteria are represented mainly by the orders Nostocales and Oscillatoriales. Coccolithophorids and silicoflagellates (*Dictyocha fibula*) are also present.

The occurrence of microphytoplankton in aphotic layers was previously reported in mesopelagic (300–500 m) and bathypelagic waters (1,000–3,000 m) of the eastern Indian Ocean (Liu et al. 2022), and between 2,000 and 4,000 m depth across subtropical and tropical areas of the Atlantic, Indian, and Pacific Oceans (Agustí et al. 2015). More recently, the presence of healthy microphytoplankton cells down to 1,000 m depth was also recorded in the Santos Basin, Brazil (Frazão et al. 2025). These results suggest that opal ballasting plays an important role in transport of the particles containing these cells to the deep-sea (Cael et al. 2024), also providing evidence of vertical connectivity between surface and the deep ocean, and reinforcing the role of microphytoplankton to the biological carbon pump. They further suggest an important structural carbon flux that has not been fully recognized due to sampling being restricted to the euphotic layer, highlighting the importance of expanding phytoplankton sampling strategies beyond the photic layers. Finally, our study reinforces the value of open-access environmental databases for achieving a more comprehensive understanding of deep-ocean biodiversity, its role in biogeochemical cycles, and its ecosystem services.

Keywords

phytoplankton, deep-ocean, biological carbon pump, databanks

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Conflicts of interest

The authors have declared that no competing interests exist.

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